



MINISTRY OF POWER

# EXPLOSION AT WALTON COLLIERY YORKSHIRE

## REPORT

On the causes of, and circumstances  
attending, the explosion which occurred at  
Walton Colliery, Yorkshire,  
on 22nd April, 1959

*by*

**T. A. ROGERS, C.B.E.**

**H.M. Chief Inspector of Mines and Quarries**

*Presented to Parliament by the Minister of Power  
by Command of Her Majesty  
September 1959*

**LONDON**

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# **Report on the Causes of, and Circumstances attending, the Explosion which occurred at Walton Colliery, Yorkshire, on 22nd April, 1959**

11th September, 1959.

*The Right Honourable Lord Mills, K.B.E.,  
Minister of Power.*

MY LORD,

1. In accordance with your direction under Section 122 of the Mines and Quarries Act, 1954, I have held a Public Inquiry into the accident which occurred at Walton Colliery, Yorkshire, on 22nd April, 1959, and now have the honour to submit my Report.

2. I find that five men lost their lives in an explosion of firedamp, caused by an electrical arc from a damaged trailing cable and extended by coal dust, in the No. 5 Unit of 10 East District in the Top Haigh Moor Seam.

## **CONDUCT OF THE INQUIRY**

3. I opened the Inquiry at the Town Hall, Wakefield, on 29th June, 1959, and sat until 3rd July, then again from 4th to 12th August. Fifty-two witnesses gave evidence. The following parties were represented:—

*The Ministry of Power* by Mr. H. J. Perrins, O.B.E., H.M. Divisional Inspector of Mines and Quarries ;

*The National Coal Board* by Mr. C. M. H. Glover, Solicitor to the North Eastern Divisional Coal Board ;

*The National Union of Mineworkers* by Mr. J. R. A. Machen, President, Yorkshire Area ;

*The National Association of Colliery Overmen, Deputies and Shotfirers* by Mr. E. Lockett, Secretary, Yorkshire Area ; and

*The National Association of Colliery Managers and the British Association of Colliery Management* by Mr. A. Maurice Smith, Solicitor.

## **GENERAL PARTICULARS OF WALTON COLLIERY**

4. Walton Colliery (formerly known as Sharlston West) is a safety lamp mine situated near Wakefield in the West Riding of Yorkshire ; its general layout, so far as it is relevant to this Report, is shown on Plan No. 1. The colliery employed 1,285 men underground and 298 on the surface, a daily output of 2,200 tons being obtained from the Top Haigh Moor, the Low Haigh Moor, the Kent Thick and the Birkwood or Lidgett Seams. About half of this output was from the Top Haigh Moor.

5. The colliery is owned by the National Coal Board and is situated in the No. 7 (Wakefield) Area of the Board's North Eastern Division. It was managed by G. S. Senior and there were two under-managers, one of whom, H. H. Gregg, had responsibilities which included the working in the Top Haigh Moor seam where the explosion occurred. The Group Manager was T. Dodd and the Area General Manager H. Saul.

## THE 10 EAST DISTRICT

6. Plan No. 1 shows the 10 East District, which lies in the Top Haigh Moor seam on the East side of the South West Haulage Road connecting the No. 2 shaft to the Haw Park shaft. The inset to this plan shows on a larger scale the ventilation layout of 5's Unit in which the explosion occurred. Plan No. 2 shows 5's Unit in detail, as it appeared after the explosion.

### RECENT DEVELOPMENT AND WORKING OF THE DISTRICT

7. The Haigh Moor seam at Walton Colliery appears as two leaves, each about 3 feet thick, of which only the upper, or Top Haigh Moor seam, is worked in the 10 East District. The two coals are separated by a band of hard fireclay about 7 feet thick and the Top Haigh Moor seam is overlain by a thick bed of strong sandstone. The depth from the surface is about 460 yards where the accident occurred. Faults had been encountered in 10 East District in 1955 and further development there had taken the form of driving two roads 22 yards apart through the faulted area to develop a longwall face, 40 yards long and known as 10 East 1's, which was advanced to the boundary then stopped on the 23rd July, 1958, leaving solid coal on each side.

8. Two faces were then worked north and south respectively from this development. The first of these faces, 10 East 2's, was stopped at faults in February, 1959, and at the time of the accident its old loader gate was being continued as a stone drift, known as 2's Drift, through those faults. This drift was intended to form part of a new main return airway for 10 East District.

9. Coal to the south of the 10 East Trunk Conveyor Road was intended to be worked by a double unit longwall face about 280 yards long, advancing to the south. In the general plan of operations a face, the second to be worked from 1's Development, was taken some 20 yards wide for a distance of about 40 yards to the south. The western side of the new development was then to be worked as a face 40 yards wide and advanced for about 100 yards to the west to connect with a heading known as 5's New Loader Gate, which was being simultaneously driven to the south from a point further outbye on 10 East Trunk Conveyor Road. The face was then to be continued westward so that eventually a double unit face about 280 yards long would be advanced to the south, after 2's Drift had afforded a new return airway for the district.

10. At the time of the explosion the 40 yards face, known as 5's Unit, had advanced about 97 yards. A small further advance, which would have been made in a few days but for the explosion, would have brought it to the position where it could have been stopped to await the connection with the New Loader Gate. At the right (or north) end of the working face the roof was ripped to form a road supported by steel arch girders 12 feet wide by 8 feet high. This road, known as 5's Intake Gate, was intended to become the return airway for the right (or western) unit of the 280 yard face when it was finally developed. It was connected to 10 East Trunk Conveyor Road by means of 5's Intake Slit, which was a passage some 37 feet long that had originally been made about 6 feet wide and about the height of the seam.



11. At the left (or south) end of the 40 yard face, a passageway of seam eight and some 12 feet wide, as shown in the sectional view inset on Plan No. 2, was being left so that it could eventually become the left side of the main longwall face to the south. This passageway, known as 5's Ribside, was formed by the coal and by a pack about 12 feet wide ; at the outbye end of this pack a gap some 9 yards long had been left affording access to the waste, which had not closed but in which thin slabs of stone had fallen from time to time. A bottom loading belt conveyor in this passageway carried coal from 5's Face to a similar conveyor on 5's Belt (or Return) Gate ; the latter conveyor discharged on to the 10 East Trunk conveyor at the same transfer point as the stone loading conveyor from 5's Drift.

### VENTILATION

12. In the planned system of ventilation air entered 10 East District from the South West Haulage Road, partly along 10 East Main Haulage Road and partly from a second source some 400 yards nearer to the Hawark Shaft. These two air currents joined inbye the Loading Point and then took the course to and from 5's Unit shown on Plan No. 1. This course was on conventional lines, but because of heavy leakage losses beyond the Loading Point only a small proportion of the 12-16,000 cubic feet of air per minute available there reached the face of 5's Unit. A few days before the accident, a direct connection had been made by means of a scour driven through the waste between 5's Intake and 5's Return but sheets had been erected in it to prevent short circuit of the ventilation there.

## EVENTS ON THE DAY OF THE EXPLOSION

### EVENTS BEFORE THE EXPLOSION

13. The coal on 5's Unit was undercut by an electrically driven coal cutting machine, blasted and hand-loaded on to the face conveyor. Coal was filled on the morning and afternoon shifts ; the Intake gate ripping was advanced on the afternoon and on the night shifts ; the stone pack on the Ribside was advanced on the night shift with stone from Intake ripping. There had been difficulty in achieving the management's objective of obtaining two cuts in each 24 hours and accordingly, in order to maintain work during the break of 12.30 to 1.30 p.m. between the day and afternoon shifts, two coal cutting machine men and an overman worked a supplementary shift from 8 a.m. to 3.30 p.m.

14. On the afternoon shift of 21st April, 1959, the day before the explosion, coal which had been prepared was filled and 5's Intake Gate ripping was advanced. On the night shift some colliers were employed squaring out the right hand corner of the face and the rippers for the Intake Gate, having no work to do there, spent their shift at the new connection where a number of shots, said to be about 12, were fired in the one, thus enlarging the holing.

15. On the day of the explosion, the morning shift filled loose coal left by the afternoon shift and from shots fired in each corner of the face. Three men spent the whole of their shift transporting stone in a small tub from the new connection to the intake roadhead where it was put into the

roadside pack. At about 10.0 a.m. the coal cutting machine operators of the supplementary shift (W. Hudson and W. Wardle) arrived and began to turn the machine round at the left corner of the face. During this operation the machine struck and displaced the tension end of the Ribside conveyor, so that it had to be stopped. The driving head of the face conveyor was advanced into its new track and the tension end of the Ribside conveyor moved, but the coal cutting machine could still not be worked because its jib had then become fast in the undercut. A shot fired over the jib (between 11.0 and 11.30 a.m.) released it and the machine was turned, jibbed in and made to cut for about 10 feet to a stump of coal which required to be filled off. The tension end of the Ribside conveyor was placed in its proper position, both conveyors were re-started and the coal cutting machine trailing cable was disconnected and re-threaded into the new cutter track. No electrical trouble was experienced with the face equipment during the day shift.

16. By 12.30 p.m. the day shift had left the face, except for two conveyor attendants, J. Rothery and C. E. Ray, who remained to assist the men on the supplementary shift. On his way out, the day shift deputy, F. Canham, saw J. Williams, a drifter employed in 2's Drift, eating his snap at 2's Transfer Point. He asked Williams to keep an eye on the two conveyors until the afternoon shift arrived.

17. Thus, at about 12.30 p.m. five men were actually in 5's Unit, namely, L. E. Coe (the overman), W. Hudson, W. Wardle, J. Rothery and C. E. Ray ; J. Williams was just outside it. There were no eye witnesses to say what happened during the next half hour. Of the six men, the first five were killed in the explosion. The sixth man, Williams, escaped with minor injuries, but he remembered little.

#### THE EXPLOSION

18. At about 1.0 p.m. the lights went out at 10 East Loading Point, the conveyor stopped and the three men working there felt a rush of air and dust from inbye. One of them, T. Furlong, telephoned to the top of 10 East Main Haulage Road asking for the deputies to be sent back ; he also telephoned to the overman, H. Cunningham, saying that he thought there had been an explosion. Furlong then opened the switch controlling the supply of power inbye of the Loading Point and, with his two work-mates, went inbye but returned after making an unsuccessful attempt to enter 5's Unit.

19. Canham and another day shift deputy, H. Towler, who had reached the top of 10 East Main Haulage Road when Furlong telephoned, went back into the district. On their way they met Williams making his way out ; he could only tell them that he had been bowled over and thought there had been an explosion. Towler isolated the gate-end switches near 2's Transfer Point and then, with Canham, tried to enter 5's Unit by the Intake Slit. They found themselves unable to go beyond the end of that Slit because of fouled air. Two afternoon shift deputies, J. Wilsher and J. Bedford, also attempted to go up the Intake Gate, but Wilsher's lamp went out after he had travelled about 15 yards.

20. The under-manager, H. H. Gregg, had been with Cunningham when Furlong telephoned and these two went inbye, Gregg having first informed

the surface electricians (at approximately 1.10 p.m.) that there had been a power failure in 10 East district. On reaching the top of 10 East Main Haulage Road, Gregg learned that Williams had been injured and concluded that there had been an explosion in 2's Drift, where Williams normally worked. He accordingly telephoned to the manager (at about 1.25 p.m.) and asked for ambulances and stretcher parties to be made available. When he reached 5's Intake Slit, Gregg saw that the belt had been blown off the Trunk Conveyor for a distance of some 50 yards and that there was every sign of an explosion having occurred in 5's Unit. He then arranged for a message to this effect to be sent to the surface, and at this stage Wakefield Central Rescue Station was called on for assistance. The Rescue Station received the call at about 2.0 p.m. and a team left at once for the colliery.

#### RESCUE AND RECOVERY WORK

21. Gregg with others then entered 5's Return Gate and travelled along it to the ripping lip without difficulty. When, however, he attempted to go under the lip his flame safety lamp went out and he had to withdraw. Gregg put in hand the restoration of the brattice sheets in 10 East Trunk Conveyor Road and in the new connection and then with others made a further attempt to enter 5's Unit via the Intake gate. This attempt failed because of fouled air.

22. By 2.50 p.m. a fresh air base had been established at the entrance to 5's Intake Slit and from here rescue men, using self-contained breathing apparatus, explored the Unit via 5's Intake and quickly found the bodies of four men. On attempting to travel down the Ribside, however, they encountered a fall and accordingly returned to the fresh air base. They then inspected 5's Return Gate and located the fifth body. All the bodies were recovered: the places at which they had been found are shown on Plan No. 2.

23. The clothing on each body was searched for prohibited articles by a police officer, first on arrival at the surface and later at Wakefield City Mortuary. No contraband was found.

24. At about 7.50 p.m. a series of "bumps" was heard which suggested that further explosions might be occurring in 5's Unit. This news was telephoned to the surface and after a conference there it was decided to withdraw the fresh air base to near 10 East Loading Point. This was a correct decision, since no-one remained in 5's Unit and there would have been no justification whatever for risking further loss of life. At about 10.50 p.m. a decision was taken to seal off 5's Unit to limit the spread of any further explosion. The construction of stoppings was begun and while this work was going on the air returning from the district was sampled and measured at hourly intervals. Since these samples contained steadily decreasing quantities of explosion products, the seals were not completed.

25. On the afternoon of 24th April there seemed to be no risk of any further explosion and a preliminary inspection was made by two of H.M. inspectors, W. M. Cumpsty and T. W. English, who, accompanied by the manager and A. Wright, the Divisional Mining Operations Engineer of the National Coal Board, entered the affected area via the intake stopping. Their inspection showed that there was no risk of a further explosion.



The stoppings were removed, the ventilation restored and the Unit left over the week-end for any remaining explosion products to clear.

26. During these operations a partly smoked cigarette was found in the cage of a canary which was being carried by a rescue team. I have no doubt that this cigarette had been accidentally introduced on the surface where the birds were kept in a room to which many people had access ; it is understandable that the surface searchers did not see it.

27. H.M. Inspectors, assisted by officers of the Safety in Mines Research Establishment, began a thorough investigation of the affected area on 27th April ; the work was done in the presence of representatives of the National Coal Board and other interested parties. The results of these investigations, and the conclusions which I draw from them, are described below.

## THE CIRCUMSTANCES OF THE EXPLOSION

### SIGNS OF VIOLENCE

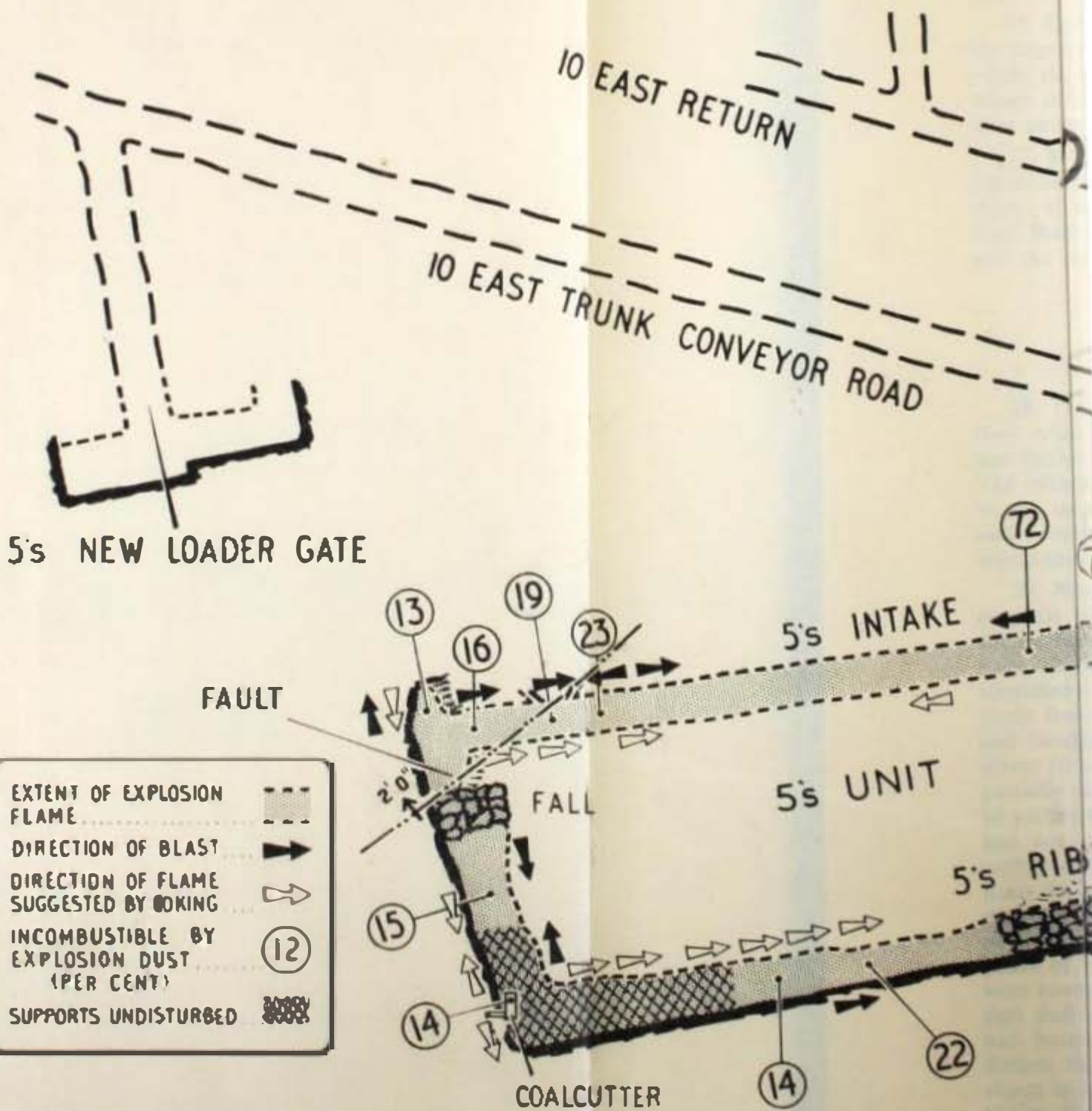
28. There were no indications of great violence in 5's Unit. Charles Ray, whose body was found at 5's Return Gate ripping lip and was the one farthest from 5's face, was the only one who suffered violent injuries. The other four men died from carbon monoxide poisoning ; asphyxia due to the inhalation of coal dust accelerated the deaths of Wilfred Wardle and Lawrence Coe. All the dead men sustained burns, but in no case would these alone have been fatal.

29. Physical damage was confined mainly to the displacement of roof supports and to the disturbance of conveyor belts. The supports in 5's Intake were undisturbed (except for two props which appeared to have been blown out from under the ripping lip) and a flame safety lamp, later identified as that issued to Coe, was found hanging undamaged some 5 yards from the ripping lip. Face supports (consisting of wooden props and bars) had been displaced between the Intake roadhead and a point about 10 yards from the Ribside, but apart from some chocks which had partially collapsed the waste edge supports were still standing. On the 10 yards of the face nearest the Ribside, and for 25 yards along it, supports had not been disturbed and there was little sign of violence. Farther outbye on the Ribside, supports had been dislodged and about 55 yards from the face there had been a heavy fall of roof which extended for a distance of 37 yards ; it was estimated that the roof had fallen to a height of about  $3\frac{1}{2}$  feet above the seam. The bottom layer of this fall was a panel of sandstone some 9 to 12 inches thick. The ends of this panel were covered with explosion dust and it was clear that it had fallen before that dust had settled. Outbye of this fall most of the Ribside supports had been dislodged and the conveyor head had been disturbed. In 5's Return the top belt of the conveyor had been broken and the brattice sheets in the new connection between 5's Return and 5's Intake, had been blown down.

30. Outbye the Intake Slit there were few signs of violence. The brattice sheets in 10 East Trunk Conveyor Road had been affected and the top belt of the conveyor had been displaced towards the side of the road remote from the Intake Slit. In 2's Unit, the blast slightly injured Williams,



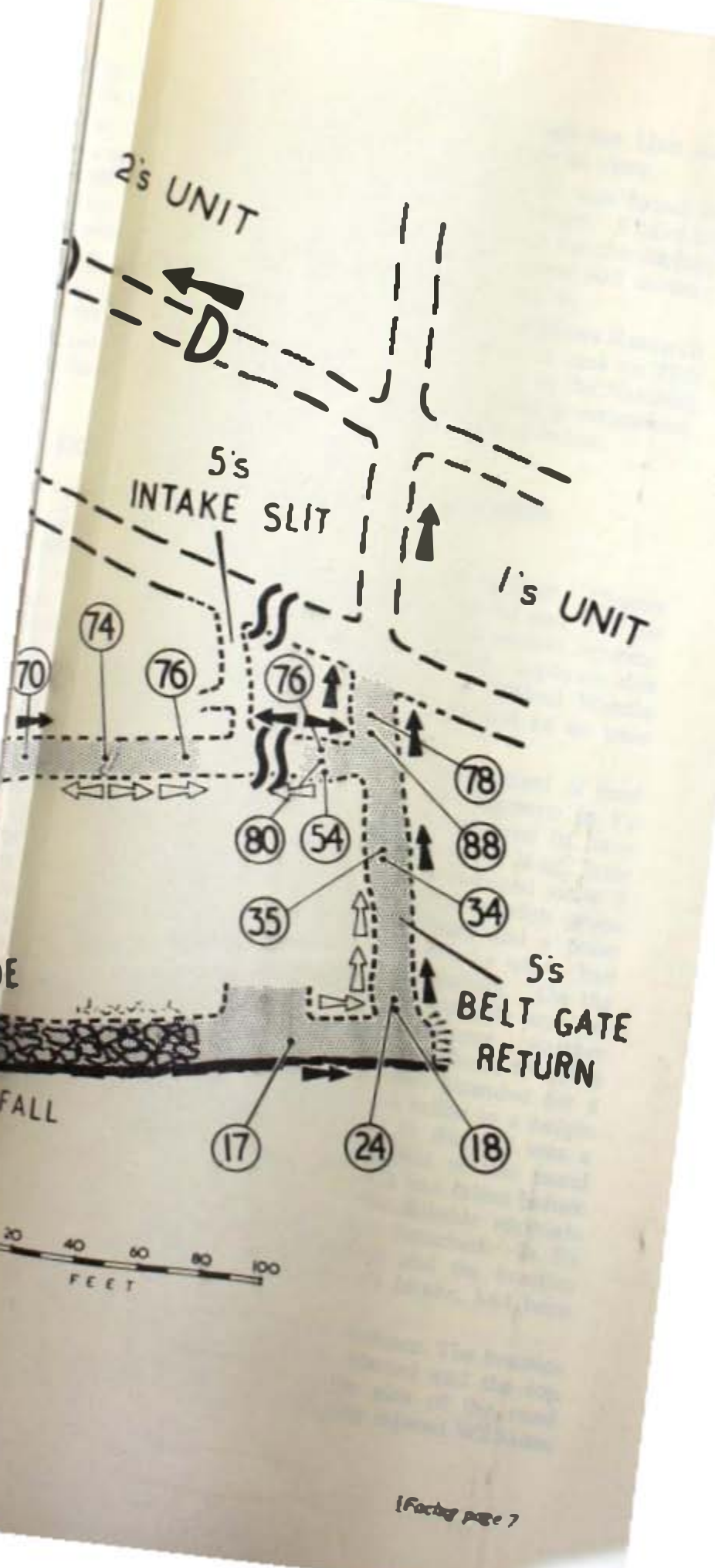




## WALTON COLLIERY

Plan showing development of the explosion

FIGURE 1



36. The trailing cable was that which supplied the coal cutting machine. When the outer sheath of that cable was examined closely it was seen to contain a superficial cut at about 11 feet, and a deep cut about an inch long at about 21 feet, from the machine end. The damaged cable was carefully dissected. Beneath the cut, and between the outer sheath and the screened conductors, there was a patch of white powder. This was later shown to be similar in composition to the rock of the roof. There had been severe arcing between a power conductor and its earthed screen; the wires of both showed signs of fusion and there were indications of heating on the inside of the cut in the sheath. Plates I-IV show the cable before, and at various stages during, dissection.

37. I conclude that the arcing occurred at the time of the explosion for there was no electrical defect except the damaged cable to account for the tripping of the earth leakage protective devices which had occurred simultaneously with the explosion. Such an arc could have firedamp. There was evidence that at the time of the explosion the cable was partly coiled up near the coal cutting machine, so that the damaged part was well within the area in which I conclude that the explosion had begun. The control wheel of the coal cutting machine had been found in the "check" position, that is to say, rotated sufficiently back from the "on" position to open the remote control contacts at the gate-end switch and make dead the power conductors of the trailing cable. This fact does not rule out the damaged cable as an igniting agent; had an arc occurred, the machine operator could easily and instinctively have moved the control wheel the small amount required to reach the "check" position.

38. I conclude that arcing from the damaged cable was the igniting agent.

#### THE CAUSE OF THE DAMAGE TO THE CABLE

39. It was suggested at the Inquiry that the cable might have been damaged:

- (i) by an accidental blow from a hand pick;
- (ii) by a broken wire in the coal cutter haulage rope; or
- (iii) by a stone, possibly one projected by shotfiring.

The first two of these hypotheses are, in my view, improbable. Though the coal cutter haulage rope contained broken wires, there were no signs of fusion on the protruding ends. Moreover, a micro-chemical analysis of material from the fused conductor, together with a metallurgical examination of the picks in use on 5's Unit, showed that there were no unusual traces either of iron in the fused copper conductor or of copper on the steel pick points. These circumstances are not conclusive since the initial damage was not necessarily caused while the cable was alive. A stronger objection is that neither hypothesis accounts for the presence of a quantity of rock dust inside the cable.

40. On the whole, I think that the last hypothesis was the most probable one, though it is impossible to say how or when the damage occurred. Intervals of a few hours to a day before the explosion were suggested, but the period may conceivably have been longer. A contact made between the conductor and its screen while the cable was "dead" could have been



broken by the resilience of the insulating material. The breakdown at the point of damaged insulation could occur much later. It is not surprising that the defect had escaped the notice of the machine men.

### THE NATURE OF THE FUEL

41. In a colliery explosion there is frequently the possibility that both firedamp and coal dust were involved. In such circumstances it is necessary to consider the possible pre-explosion disposition of gas and dust before making any attempt to estimate how far each fuel did in fact participate in the explosion.

42. The amount of coked dust deposited on vertical surfaces along 5's Face and the fact that specimens of explosion dust contained about 14 per cent. of incombustible matter suggested that there was enough inflammable dust present for the explosion on the face itself to have been one of coal dust alone. The igniting agent was, however, an electric arc. It has been shown experimentally that such an arc can ignite a pre-formed cloud of coal dust of suitable composition, but there was no evidence at all to suggest that such a cloud could possibly have existed before the explosion. Moreover, experience has shown that explosions are not readily set up and propagated with increasing violence through coal dust alone on working faces, one reason being that the force of an explosion is largely dissipated in an open waste. In this case, the flame seems to have increased in violence as it travelled along 5's Face and I conclude that the explosion was propagated along this face mainly by gas.

43. As gas was undoubtedly present at the site of the electric arc on the working face, it may be inferred that it was also present on the Return side of that site and possibly for some distance down the Ribside. There could conceivably have been sufficient to propagate an explosion throughout the Ribside and, indeed, along 5's Return, but I consider this unlikely. In my opinion, coal dust raised in the Ribside played a part in the explosion in the lower end of that passage and also along 5's Return. It seems significant that the percentage of incombustible dust found in post-explosion specimens increased from as little as 18 per cent. at the inbye end to 78 per cent. at the outbye end.

44. I do not think it likely that flame could have been propagated so far down 5's Intake simply by fuel blown from the face by the force of the explosion. I consider it probable that in addition to such fuel there was coal dust at the roadhead and firedamp in the vicinity of the fault, particularly at the ripping. Here again, the incombustible content of post-explosion specimens increased from 13 per cent. at the face to 76 per cent. where the flame died out.

45. I am of the opinion that the explosion was much stronger on the Return than on the Intake side and that blast from 5's Return had gone part way up 5's Intake and some through the Intake Slit. This conclusion is supported by the confused indications of direction of blast around the inbye end of the Intake Slit and the dislodgment of the trunk conveyor belt towards the side remote from the Slit.

46. My conclusion is that this explosion was one based on the joint contribution of gas and coal dust. It began when an electric arc from a damaged trailing cable ignited firedamp near the left corner of 5's Face.

The resulting flame raised dust into the air as it travelled along the working face and down the Ribside. Flame and coal dust were projected from the face into 5's Intake, probably finding additional fuel at the road-head. At the same time, the explosive force travelling down the Ribside raised and ignited coal dust there and continued the explosion into the Return Gate.

#### AMOUNT OF GAS

47. It is useful, in considering the source from which the gas involved in this explosion might have come, to attempt to estimate the amount involved. Nothing like a precise estimate is possible, of course, but the upper limit would be the quantity required had sufficient gas been present to account entirely for the observed spread of the flame. This was a mild explosion and I accept the view put forward that its effects could have been produced by a weak mixture. The total volume of flame which traversed the face and roads involved was calculated to be about 50,000 cubic feet, which could have resulted from the ignition of some 17,000 cubic feet of a 7 per cent. mixture of gas and air; this would in turn have represented 1,200 cubic feet of methane. As the most likely explanation of the development of the explosion is that both gas and coal dust were involved, the quantity of gas required would be considerably less than this. How much less is a matter of speculation.

#### THE SOURCE OF THE GAS

48. During its existence 5's Unit must have been statutorily inspected by deputies at least 400 times and, in addition, examinations for firedamp would have been made on the very many occasions when shotfiring took place. There was, however, no record of firedamp ever having been found before the explosion. Indeed, tests for firedamp were made on 5's Face within two hours before the explosion: a shotfirer, H. Walker, tested between 11.0 and 11.30 a.m. just before he fired a shot to free the jib of the coal cutting machine; and during a pre-shift inspection Canham made tests in the left corner of the face at about 12.30 p.m. Both men testified that they found no sign of gas.

49. Gas was obviously present at the left corner of 5's Face when the explosion occurred at about 1.5 p.m., some 35 minutes after Canham had tested there and it was suggested at the Inquiry, not surprisingly, that something unusual happened during this time to produce the gas. This view is supported by consideration of the amount of methane generally produced in these workings.

50. The seam was described as "moderately gassy", producing some 200 cubic feet of methane per ton of coal worked, but statutory samples of the return air from 5's Unit taken on 29th February and 28th March had been shown by analysis not to contain firedamp. These were the only samples of the return air taken after 5's Unit had started, though samples should have been taken weekly during the first 30 days of its life. After the explosion H.M. Inspectors made tests in the machine undercut, the pack to the right of 5's Intake, shotholes in coal and holes drilled into the floor to investigate the possibility of firedamp from those places having been involved in the explosion. Using a tube they were able to extract small quantities of gas containing high concentration of methane.



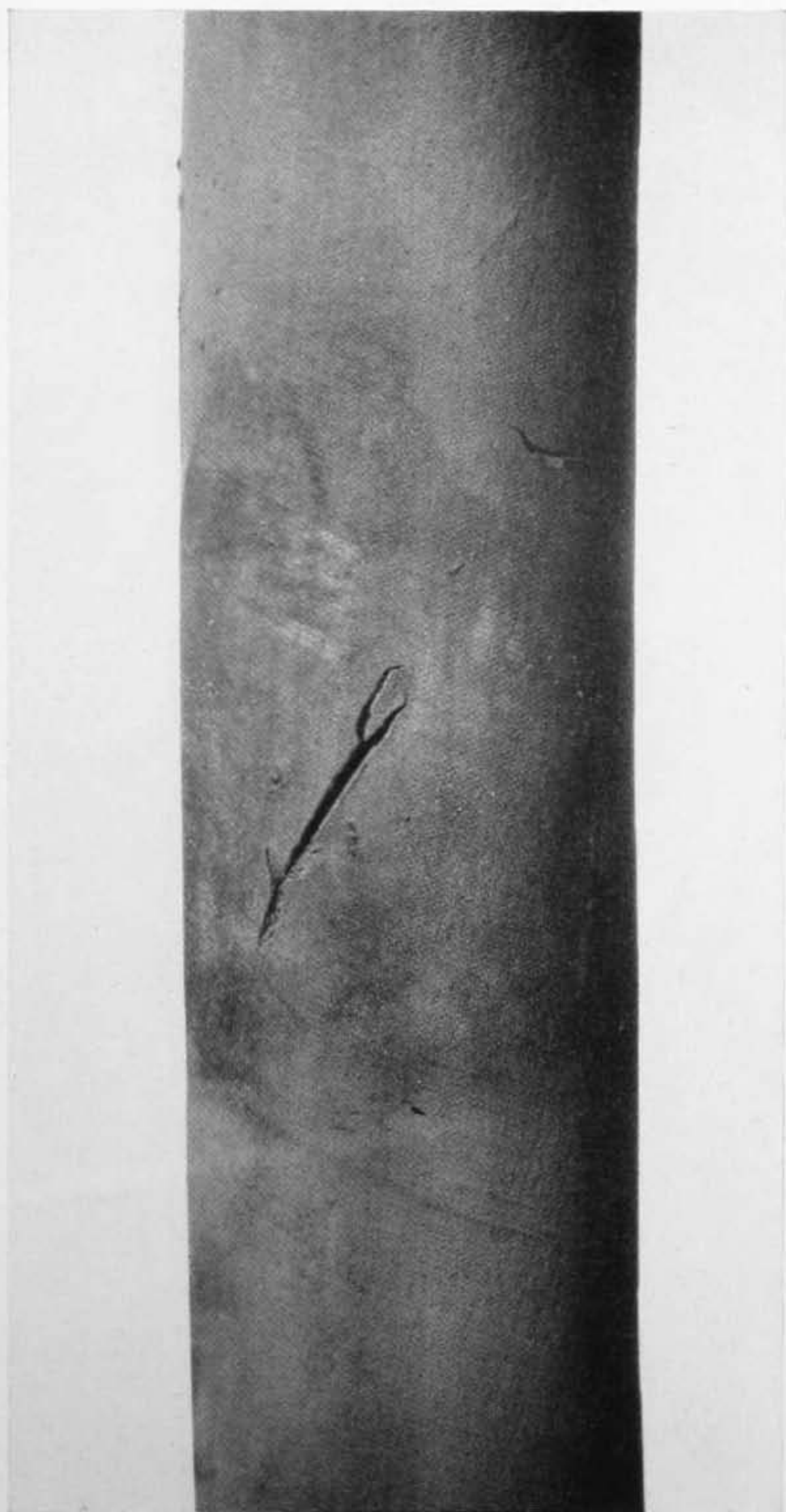


PLATE I.—View of damaged cable, showing cut in outer sheath.



PLATE II.—View of interior surface of damaged sheath showing the cut and white dust.



PLATE III.—View of damaged screen of power conductor (conductor removed from cable).



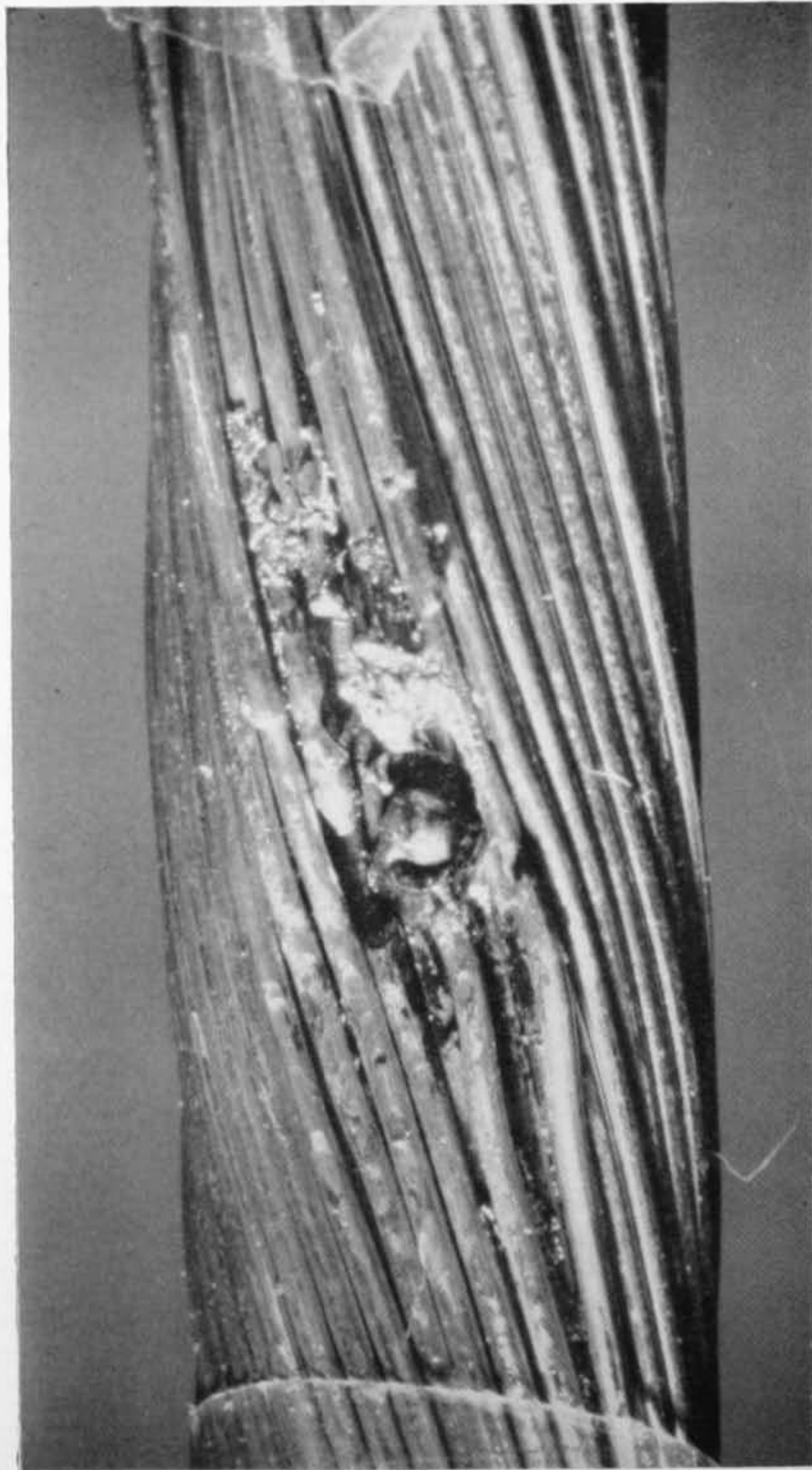


PLATE IV.—View of damaged conductor removed from cable, showing fusion.

51. Determinations made in the general body of the air some days after the explosion, but when no coal was being worked, showed a methane content of 0.35 per cent. in 2,100 cubic feet of air per minute in 5's Return, which indicated a "make" of about 7 cubic feet of methane per minute. Determinations made after 5's Face had been connected with 5's New Loader Gate, and when coal was still being worked on the 22 yard face of the latter, showed a make of only about 12 cubic feet of methane in 6,000 cubic feet of air per minute.

52. The general make of firedamp was clearly small. It might have been increased somewhat by additional crushing of the coal; that such crushing existed during the few days before the explosion was shown by the coal having been a little easier to work, by the jib of the coal cutting machine having become fast in the undercut on the morning of the explosion and by some indications of weighting on roof supports in the Ribside. Nevertheless, I conclude that the general make of methane in the seam could not in half an hour or so have produced the firedamp involved in the explosion, and that it was necessary to look for some other source.

53. I conclude that methane did not come from the hard sandstone roof. The only other possible source was the underlying Low Haigh Moor Seam. There is room for argument, however, about the possible size, rate and place of the emission. An emission would be most likely to result from the formation of suitable channels in the fireclay separating the two seams. In a post-explosion examination one of H.M. Inspectors, W. H. N. Carter, found a break in the floor along the Ribside and I consider that there were probably similar breaks in the inaccessible waste. In my view these breaks were the result of the perimeter of 5's Unit excavation being subjected to increased pressure from its overlying strata. This pressure developed because the thick sandstone bed above the seam supported the load on the 40 yard wide excavation substantially without breakage and transmitted that load to the perimeter of the excavation. In these conditions the fireclay bed would tend to "heave" a little and thus fracture. I consider it likely that methane was emitted from these breaks in the waste and was carried by the leakage currents to the lower end of the Ribside where it could have taken part in the explosion. I am not greatly impressed by the suggestions made at the Inquiry that a fall in the waste expelled this gas on to the face in the vicinity of the coal cutting machine. I do not think it is necessary to postulate such a happening, for which there is no evidence. In my opinion the gas on the face came from the downthrow fault of 2 feet or so which had been exposed in the right hand corner. This fault was a line of inherent weakness which would predispose the formation of an open break along its plane by the forces I have described. Any emission of gas from the floor at this fault would be carried forward by the ventilation, some through the waste and some towards the point of ignition. In my view, all the emissions which occurred took the form of heavy seepages rather than a sudden outburst, since the weak ventilation current was able to dilute the total emission to a concentration not greatly above the lower limit of inflammability.

54. Shortly after the explosion a heavy concentration of firedamp was found to have accumulated in the inbye half of 5's Intake Gate, that is to say towards the highest point in the Unit. This considerable volume of gas must have been released after the explosion. I consider that it also came



from floor breaks at the fault and elsewhere which would have been aggravated by strata movement due to the displacement of supports. The "bumps" heard after the explosion, and considered at the time to be further explosions, were in my view noises caused by such strata movement.

#### THE STANDARD OF VENTILATION

55. The ventilation of 10 East District inbye the Loading Point had nothing to commend it.

56. Air measurements made on 6th and 8th May by J. Carver, one of H.M. Inspectors, showed that serious ventilation losses were occurring beyond the Loading Point. Those made on 6th May were in conditions approximately closely to those prevailing at the time of the explosion, though it was impossible to reproduce those conditions. When the measurements were made there was only a crawling road through the part of the ribside which had fallen but, bearing in mind the open waste and the gap in the pack, I conclude that the consequential restriction would have little effect on the quantity of air entering 5's Unit. Neither in my view would the restriction have altered materially the relative quantities of air passing through ribside and waste.

57. A quantity of 12,165 cubic feet of air per minute was measured some 300 yards outbye of the intake slit, but of this only 2,240 cubic feet per minute reached a point on 5's intake 10 yards inbye the intake slit. At a point 10 yards back from 5's Face the quantity was further reduced to 1,580 cubic feet per minute. This loss was shown by tests with chemical smoke clouds to be caused by air leaking through the left-hand roadside pack into the waste. On 5's Face, starting from the intake end, smoke tests showed that air was coursing down the waste, but this leakage became less marked as the ribside pack was approached. In the waste immediately adjoining this pack the air was stagnant. On the face itself, the air velocity in the restricted area over the coal cutting machine was estimated by smoke tests to be 22.5 feet per minute. In the left hand corner the air quantity was too small to be measured. Towards the outbye end of the Ribside there was the gap 9 yards long in the packing and through this gap a quantity of at least 825 cubic feet of air per minute was passing. The total quantity must have been greater than this, since it was only possible to make a measurement in respect of part of the opening in the pack.

58. The further tests made on 8th May produced somewhat different results because by then the gap in the pack had been filled in. Nevertheless, they confirmed that losses of the same kind were still occurring and that the air current in the left hand corner of the face was so slow as to be "indeterminate".

59. These conditions were the result of widely distributed defects in planning and execution which in my view arose from a failure to appreciate fully some elementary, but fundamental, considerations. For instance, immediately outbye of 5's Unit in a distance of about 280 yards there was severe leakage from intake to return amounting to some 50 per cent. of the air. The existence of this leakage had been known as early as March, 1958, and its extent had been measured by the safety officer, K. Staples, in January, 1959. It was not surprising that this leakage existed. The

roadside packs of I's Unit had been built with rock ripped down from the hard sandstone roof. Although this material was excellent from the point of view of roof support, it was much less so from the point of view of ventilation for there would have been very little small stone to serve to fill up the joints and to make the packs reasonably airtight. Moreover, the strong roof of the old I's Face (the 40-yard width of which had been settled largely by surface support considerations) would be unlikely to consolidate the packs or to fall in the waste. These conditions were bound to allow considerable leakage. Section 59 of the Mines and Quarries Act, 1954, makes it unlawful to use roads as intake and return airways unless there have been taken such steps as are necessary to minimise the leakage of air between them. At the time of the explosion the relevant length of the two roads concerned lay within 450 feet of a working face and so was outside the scope of the section, though this had not always been the case. There is also room for argument as to what steps are "necessary" if the quantity of air arriving at the end of a road is adequate for ventilation purposes. The management was in fact attempting to meet the situation by driving a new return airway (2's Drift) as quickly as possible.

60. Notwithstanding this loss of air, the quantity reaching 5's Intake Slit might still have been satisfactory for the ventilation of 5's Unit had there been no further loss. In point of fact, however, the layout was such as to encourage other leakages. The Intake Slit was low and narrow, and its cross sectional area at its smallest part was only about 10 square feet; this small passage, 37 feet long, was bound to restrict the flow of air through it to some extent and so cause more air to leak into the return at 2's Transfer Point. In my view the steps taken to minimise this leakage could have been more effective. The means actually provided—two brattice sheets—must have allowed a considerable amount. Mr. Glover suggested that these particular sheets had been supported on carefully made wooden frames prepared by a joiner but though one witness agreed, others mentioned only a cross-bar with either one or two uprights. Whether such frames were used or not, it is well known that brattice sheets at their best are less effective than doors. Indeed, evidence was given of a rule, made in 1947, by the North Eastern Division of the National Coal Board, which said :

"Ventilation must be diverted or regulated by doors at least in duplicate. Brattice sheets must not be used as a means of diverting or regulating main air currents, but should only be used for hurdle sheets and for ventilating fast corners."

61. Carver's measurements inbye of the Intake Slit illustrated further defects some of which were, not surprisingly, a reproduction of those found when I's Face, also 40 yards wide, was being worked. But an additional source of leakage came into being on the Friday before the explosion when the backward extension of 5's Intake holed through into 5's Return, so providing another route by which more of the ventilation of 5's Unit could short-circuit. This connection was necessary for the ultimate development of the double unit longwall face, but the evidence does not in any degree convince me that it was at all necessary to have it made at that stage. When made, it was closed with brattice sheets, the weight of the evidence suggesting that two such sheets were provided. Whatever their number, however, they could not have prevented serious leakage at that point to the detriment of



the quantity of air reaching 5's Face. This leakage would have been increased by traffic through the sheets. For example, there was evidence that on the morning shift before the explosion some 20 small tub-loads of stone were taken through the sheets and, since the empty tub had to pass through in the reverse direction, the number of disturbances due to this cause alone would be about 40.

62. The leakage through the left pack of the Intake Gate should have been expected from previous experience, though not necessarily in degree. The gap in the Ribside pack would intensify this leakage and cause some of the air reaching the roadhead to short circuit round the pack into the waste. The gap in the Ribside pack had existed throughout the life of the face, and I was surprised to be told of two sets of statutory air measurements made on 28th February and 28th March, 1959, which purported to show that the amount of air reaching the left hand corner corresponded almost exactly with the amount leaving the intake roadhead.

63. The Area General Manager had personally conducted the negotiations in which permission was obtained to work the coal in the 10 East District, and he directed the long term planning. He decided and recorded that the double unit longwall face could not and must not be worked until more air had been made available for it by, among other steps, the driving of the new return airway. He apparently favoured development of the double unit face by means of a 40-yard face but left the short term planning of the ventilation for the intermediate stage to the Group Manager and manager. The execution of that stage should not have presented any serious difficulties, and yet during it the explosion occurred. I have no doubt that the relative ease with which the air composition required by law was being maintained gave a false sense of security to senior and junior officials alike. Had the quantity of air passing on 5's Unit been doubled, for example, the unit would still have been receiving less than the 5 to 6,000 cubic feet of air per minute which had been provided earlier for 1's and 2's Faces. With a doubled quantity the concentration of methane might have been taken below 5 per cent. the lower limit of inflammability, for the evidence satisfies me that the firedamp which exploded was a weak mixture, containing perhaps about 7 per cent. of methane. As it was, the quantity of ventilation on 5's Unit did not provide what good practice would have regarded as a reasonable margin for contingencies.

64. This accumulation of errors of judgment and of execution in relation to ventilation of the 10 East District might have been avoided had the development plan recorded the means to be adopted for the ventilation of 5's Unit in the intermediate stage. I cannot do better than emphasise a recommendation recently made by a very expert committee:

"[there is] considerable advantage to be gained by including ventilation amongst the items covered by the general development plans for a colliery which are agreed and signed by the mine management and specialist engineers concerned in the Area and which cannot be altered subsequently in any major respect without the agreement of these signatories."

Such plans should show details of the means of ventilation to be adopted for each stage of the development of new workings.

65. The committee to which I have referred was set up by the Coal Industry National Consultative Council to study the circumstances of recent colliery explosions. This committee is generally known as the Bryan Committee after its chairman, Sir Andrew Bryan, a former Chief Inspector of Mines, who was until recently a member of the National Coal Board. Its report, which had not been published at the time of the explosion, is of the first importance and should be studied by all colliery managers and officials.

#### *Air Measurements and Firedamp Determinations*

66. The statutory ventilation samples in 5's Unit, though taken during the Friday night shift, were in fact taken in the early hours of Saturday morning. In practice this might well have been the right time to take them, but it was nevertheless contrary to the strict wording of Regulation 7 (5) of the Coal and Other Mines (Ventilation) Regulations, 1956\*, which prohibits the taking of samples on Saturdays. A further difficulty with this provision is that sampling may be impossible at, in the words of the Regulations, "the appropriate stage of the operations" on the last shift of a week if, due to some mischance, what is considered the "appropriate stage"—coal cutting, for example—does not in fact take place. Clearly, Regulation 7 (5) should be amended.

#### *Firedamp Detectors*

67. There was no firedamp detector near the coal cutting machine at the time of the explosion. Furthermore, Coe's flame lamp was found in 5's Intake and was thus not under observation; had it been at the machine it might easily have been seen to indicate the presence of gas in time to avert the consequences. In the pit as a whole, some 104 flame lamps were issued daily and more were available in the stores. Mr. Machen criticised the management for not doing enough in relation to Regulation 11 of the Ventilation Regulations to induce men to learn to use flame lamps as firedamp detectors and afterwards to carry and use them as such. On the other hand, there was evidence that the workmen considered these flame lamps to be unsuitable and would not readily undertake to carry them. It was rightly said that this was a national problem, and I do not think I can do better than to commend once again a recommendation of the Bryan Committee:

"We are perturbed by the number of incidents in which firedamp detectors have not been used or even carried by the workmen in the requisite numbers as required by the Ventilation Regulations. A new and powerful campaign at colliery level should be initiated through the consultative machinery and in conjunction with the local union officials to obtain the co-operation of the workmen in carrying out in full the requirements of the Regulations. We consider that the effectiveness of providing these firedamp detectors can be appreciably improved either by the issue of relighter lamps on a more liberal scale or else by ensuring a sufficiency of underground relighting stations. This would eliminate the risk that lamps once extinguished remain unlighted throughout the shift or alternatively the necessity of taking in spare lamps or sending lamps to bank for relighting."

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\* S.I. 1956, No. 1764.



## PRECAUTIONS AGAINST COAL DUST

68. The Top Haigh Moor Seam contained 35·9 per cent. of volatile matter and accordingly the Coal and Other Mines (Precautions against Inflammable Dust) Regulations, 1956\*, required roadway dust to contain a minimum of 75 per cent. of incombustible matter.

69. Appendix 3 gives the results of the analyses of dust samples collected in the 10 East District between May, 1958, and April, 1959. It shows that though the last interval between samples was five days more than the 30 allowed by law, the road had in fact been sampled 12 times in just over 11 months; the last set of samples had been collected 14 days before the explosion. Six samples had been collected on each sampling occasion on 10 East Main Haulage and Trunk Conveyor Roads; two more would have been necessary to reach the rate of 10 samples per mile required by law. It will be seen that only one sample of the 72 collected contained less than 75 per cent. of incombustible matter.

70. Two samples had been collected in 5's Return Gate on 8th April, although this road had a length less than the 150 feet at which sampling becomes obligatory. The roof and sides sample was found to contain 79·2 per cent. of incombustible matter but the floor sample only 66·3 per cent. It is, however, important to bear in mind that the explosion died out in this road for lack of fuel. Two samples had also been collected in 5's Intake Gate on 8th April. When, after the explosion, the results of analyses were received it became known that the roof and sides sample contained 93·9 per cent. and the floor sample 81·2 per cent. of incombustible matter.

71. Twenty-three dust samples were collected in the regulation manner by R. Lawrence, one of H.M. Inspectors, on 27th and 29th April. The results of the analyses of these samples are given in Appendix 3; they cannot, of course, be directly related to pre-explosion conditions but the general picture is that the incombustible dust content was substantially lower than that shown by the samples collected before the explosion.

72. There was evidence that the coal conveyors in the affected area had not been well maintained. On 10 East trunk conveyor there was found after the explosion spillage so excessive as to prevent a large number of rollers from turning. Pre-explosion conditions would not have been much different, as the evidence indicated that there was little coal on the conveyors when the explosion occurred. It must, however, be borne in mind that this conveyor also carried stone from 2's Drift so that some of the spillage might have been stone.

73. The bottom belt conveyors on the Return and on the Ribside were not supported anywhere on rollers; the bottom belts ran on the floor. They had run in the same track for a considerable time during which the grinding effect of the bottom belt on coal spillage must have produced a great deal of fine dust and from that point of view the equipment was unsuitable.

74. With any type of conveyor it is difficult to maintain a coal transport road in a state that will guarantee immunity at all times from the coal dust explosion hazard. For this reason it is regarded as sound practice, both here and in some countries abroad, to provide stone dust barriers as a second

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\* S.I. 1956, No. 1769.



line of defence. A National Coal Board instruction on the subject of dust barriers, dated 1st September, 1953, was read out at the Inquiry. The purpose of this instruction was to make the provision of dust barriers obligatory in mines owned by the Board. On my reading, this document required the provision of at least one barrier outside 5's Unit. In fact there were no barriers in the district and it is thus extremely fortunate that the explosion flame was confined to the area of 5's Unit.

75. Stone dust barriers are to some extent in the development stage and important experimental work on them is still being conducted. In my opinion, however, sufficient is known already to justify their provision being made a legal requirement.

76. These considerations are in my view much more important than the arguments at the Inquiry as to whether 5's Ribside was a face or a road for the purpose of the regulations. I consider it unnecessary to attempt to settle this legal argument ; as a mining engineer I regard such a place as a standing face but nevertheless, in the circumstances which obtained, a place even more dangerous than a conveyor roadway from the coal dust explosion point of view.

77. Airborne dust endangers health as well as increasing the potential explosion risk. Dust suppression measures were not being taken in the working of coal, though there was a water spray at 2's Transfer Point. I regard their absence as regrettable even though sampling by thermal precipitator indicated that dust conditions were well below the limit currently regarded as satisfactory. In my view dry cutting should nowadays be avoided as a matter of course. Wet cutting would have had the additional advantage of reducing the likelihood of incendive sparks from pyritic intrusions in the cutting horizon.

## ELECTRICAL MATTERS

### *Notice of Intention to introduce Electricity*

78. The last occasion on which, in pursuance of regulation 2 of the Coal and Other Mines (Electricity) Regulations, 1956\*, the management gave notice of intention to introduce electricity into workings in the Haigh Moor Seam was in 1954. That notice related to the use of electricity on the South West Haulage Road and no specific notice was subsequently given in respect of its extension into 1's, 2's or 5's Units. This may well have been an oversight, and it is only fair to say that it seems unlikely that any objection would have been made to the introduction of electricity into 1's or 2's Units. It might, however, have been otherwise in the case of 5's Unit because of the obvious weakness of the ventilating arrangements.

79. Before 1957 notice of intention to introduce electricity underground was required in respect of "any ventilating district" but the comparable provision in Regulation 2 of the present regulations relates to its introduction into "any part of a mine". Neither expression is free from ambiguity, and it is difficult to say exactly when notice is required by the law as it stands. In my opinion it would not be possible to devise a regulation defining

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\* S.I. 1956, No. 1760.

precisely the circumstances in which notice should be given, but it is nevertheless important that H.M. Inspectors should know when any substantial extension is to be made in the use of electricity at a mine. What is "substantial" depends on local circumstances, and I was glad to learn at the Inquiry that in this Division a sensible arrangement had been made before the explosion for individual managements to settle with the Divisional Inspector procedure that would allow the intentions of the present requirements to be complied with. I recommend that this procedure should be adopted elsewhere.

### *Trailing Cables*

80. The trailing cable was of the type known as "type 14 of British Standard 708", widely used in British mines, in which each power conductor has a protective earthed screen. Earthed screens and associated earth-leakage protection devices—in this case the core balance type—offer protection against the risk of electric shock, but not necessarily against the ignition of firedamp by an arc should an electrical fault develop as the result, for example, of physical damage to the cable.

81. The provision of this latter protection is a long standing problem of great difficulty. However rapidly a protective device operates there will still be a time lag in the physical opening of the circuit breaker and in that time incendive sparking or arcing may occur. It may be possible to reduce the danger by employing a protective system in which earth fault currents are restricted. At least one system employing this principle is already in use in this country. Such systems are unlikely to give complete protection, but when associated with individually screened cables they may reduce earth fault currents to a value at which destructive arcing, and consequent emergence of an arc outside the cable, is unlikely to occur. Another approach, already engaging the attention of research workers, lies in the development of reliable firedamp monitoring equipment. Such equipment could be incorporated in the face machinery and arranged to cut off the power supply at the gate end switch in the event of the detection of a firedamp content greater than some pre-determined level.

82. Further study is certainly required, and I recommend that discussions should begin as soon as possible between electrical engineers of the Ministry of Power and of the National Coal Board with a view to a further attack on the problem.

## MANAGEMENT OF THE COLLIERY

### *General*

83. Evidence was given on matters (including alleged contraventions of the law) designed to illustrate the general standard of management at the colliery. A number of these matters do not appear to me to have sufficient bearing on the circumstances of the explosion to justify my dealing with them in this report.

### *Changes in Staff*

84. Mr. G. S. Senior, who was manager at the time of the explosion, bears general statutory responsibility for the many unsatisfactory features which existed in the workings of 10 East District, but I sympathise with him to some extent in the position in which he found himself. He had taken

charge of this large mine about 11 weeks before the explosion in the temporary absence of the regular manager. It would naturally take him some time to get a firm grip of his new responsibilities and in that time he would depend more than is normal on his under-managers and other officials. At the time of his appointment, the 40-yard face of 5's Unit was just about to start and at that time he would not have been acting unreasonably in treating the general ventilation conditions in 10 East District as satisfactory since the ventilation records did not show any significant quantities of firedamp.

85. The ventilation difficulties in 5's must have become more pronounced as the Unit developed and this should have been appreciated by the under-officials directly responsible for 5's. Unfortunately, there was another change of management staff just after the 40-yard face began; the under-manager, A. S. Harris, who had seen the starting of the Unit, was transferred to another mine on 21st February, three weeks after the manager had been changed. Harris had clearly been concerned about air leakage when gas was found near a fault in 2's and he asked Staples to make the measurements in 10 East District. In respect of 5's development, Harris said in effect that he expected some leakage between the intake and return as 5's face advanced, but thought that this could be tolerated as he had about 5,000 cubic feet of air per minute at the Intake Slit. He would, presumably, not know that another connection would be made between 5's Intake Gate and the Return before the proposed connection with the New Loader Gate, nor have foreseen that a gap would be left in the Ribside pack as this omission apparently occurred just about the time he was succeeded by Gregg. Virtually simultaneous changes of manager and under-manager may sometimes be inevitable but are generally very undesirable from the safety point of view.

#### *Deputies' Duties*

86. Plenty of deputies were employed in 10 East, more than enough to carry out the basic statutory duties, but they were neither well organised nor well controlled. Thus, the manager did not satisfy me that he had discharged effectively his duty to assign to the deputies their respective districts and to fix meeting stations with the required identification marks. As the result of this omission some deputies regarded the pit bottom as their meeting station, while others thought that their district began at the entrance to 10 East Main Haulage Road.

87. Certain deputies, and some at least of their superior officials, lacked a proper appreciation of their statutory responsibilities. There were failures to carry out the statutory requirements in relation to inspections and reports. An afternoon shift deputy, for example, commenced his pre-shift inspection four hours before the night shift was due to enter the district instead of the statutory two hours. In other cases, statutory reports were written by deputies other than the one who had made the inspection. These disclosures were very disturbing. In particular, the irregularities in inspection times cannot be regarded as technicalities. It is possible for conditions in a district to vary quite suddenly and unexpectedly and the whole purpose of a pre-shift inspection is to make as certain as possible that a district is safe for men to enter; the statutory interval of two hours allows reasonable time for a deputy to inspect his district and brings the inspection reasonably



close to the time of entry of the following shift; to double the interval quite arbitrarily was an irresponsible action.

88. In this matter the superior officials, to say the least, were far from alert. The time worked by the afternoon shift deputy was such that had the pre-shift inspection in fact been made at the times entered in the statutory report books, he would have had to work overtime unless some other deputy had been sent to do it. The overmen concerned would be bound to know that the deputy was not working overtime and I find it difficult to believe that they did not know what was going on, even though one of them admitted that he did not examine the statutory reports made by the deputy in question.

89. The manager did not see the originals of reports made by deputies, but he regularly saw the daily summaries of them which the law allows as an alternative, and these summaries were also seen occasionally by the under-manager. The summaries showed the times entered by deputies for their pre-shift inspections, and it should have been seen quite readily that those times were not consistent with the working hours of the deputies concerned. A point of general importance arises here. Before the Mines and Quarries Act, 1954, came into force an under-manager had to read and countersign the deputies' reports daily, but he has now no obligations corresponding to those imposed on the manager by section 10 of that Act. This omission should be remedied.

90. The system of presenting statutory reports to the manager in the form of summary sheets is a sound one but it is essential for the person preparing them to understand what sort of matters ought to be specially noted. The discrepancies between shift and inspection times to which I have referred were not in fact brought to the manager's attention. If the person who is to prepare summaries has not the experience which will allow him to recognise unusual matters, he should be given careful instructions on how to perform his duties.

## SUMMARY OF CONCLUSIONS

91. I summarise my conclusions as follows:—

1. The accident was an explosion of firedamp, initiated at the left hand corner of 5's Face by an electric arc from the damaged trailing cable of a coal cutting machine. The explosion was propagated to some extent by coal dust. (Paragraphs 38 and 46.)

2. The firedamp involved emanated from the Low Haigh Moor Seam some 7 feet below and was emitted fairly rapidly, though not suddenly, from floor breaks mainly at a fault. (Paragraph 53.)

3. The ventilation of 5's Unit did not, by standards of good practice, allow a sufficient margin of safety. As the result of defects in short term planning and in execution, there were air leakages so great that the velocity of the air at the left hand corner of the face was not sufficient to deal with any substantial increase in the usual make of firedamp. (Paragraph 63.)

4. In respect of both choice and maintenance of equipment, insufficient attention was given to precautions against coal dust in 5's Unit. (Paragraphs 72-77.)

## SUMMARY OF RECOMMENDATIONS

92. In summary, my recommendations are as follows :

### *Ventilation*

1. The appropriate development plan for a colliery should show particulars of ventilation, including the means to be adopted for ventilating new workings at each stage of their development. (Paragraph 64.)

2. At all levels in the industry there should be energetic efforts to overcome the difficulties which are resulting in workmen being reluctant to carry and use firedamp detectors. (Paragraph 67.)

3. Regulation 7 (5) of the Coal and Other Mines (Ventilation) Regulations, 1956, is technically defective and should be amended. (Paragraph 66.)

### *Precautions against Coal Dust*

4. It should be made obligatory to provide stone dust barriers on coal conveyor roads underground. (Paragraph 75.)

5. Coal cut by machine should be cut "wet". (Paragraph 77.)

### *Electricity*

6. A further attempt should be made to devise an electrical protective system that will be capable of eliminating, or at least substantially reducing, the dangers of incandive arcing from a damaged trailing cable. (Paragraph 82.)

7. Local arrangements should be made between individual managements and H.M. Inspectors to ensure that notice of intention to introduce electricity is given at appropriate stages in the development of an electrical installation. (Paragraph 79.)

### *Statutory Reports*

8. Under-managers should be given legal responsibilities similar to those imposed on the manager by section 10 of the Mines and Quarries Act, 1954. (Paragraph 89.)

## ACKNOWLEDGMENTS

93. I wish to express to the various representatives who attended the Inquiry my very real appreciation of the help which they gave in bringing out the facts relating to this accident and to express to the witnesses my thanks for the frank and fair way in which they gave their evidence. I must also express sincere thanks to the Mayor and Corporation of the City of Wakefield, who generously allowed the Wakefield Town Hall to be used for the proceedings ; to the surveying staff of the Wakefield Area of the National Coal Board for the excellent plans produced for use at the Inquiry ; and to Mr. W. Fitzsimmons for his invaluable help in the preparation of this Report.

I have the honour to be, My Lord,

Your Lordship's obedient Servant,

T. A. ROGERS.

# APPENDIX 1

## Names of the men killed and injured in the explosion

	Name	Age	Occupation
<b>Killed</b>			
	Lawrence Coe... ..	38	Overman
	William Hudson ... ..	46	Machine man
	Jack Rothery ... ..	54	Belt maintenance man
	Charles Ray ... ..	53	Belt maintenance man
	Wilfred Wardle ... ..	38	Machine man
<b>Injured</b>			
	Jack Williams ... ..	43	Drifter



## APPENDIX 2

## WALTON COLLIERY

## Results of analyses of road dust samples collected in 10 East District

Extracts from M. &amp; Q. Form 207

Place of sampling				Percentage of incombustible matter in samples taken on											
				2.5.58	6.6.58	2.7.58	18.8.58	10.9.58	14.10.58	24.10.58	28.11.58	29.12.58	28.1.59	4.3.59	8.4.59
10 East Main Haalge Road Zone:															
AZ 1	Roof and Sides	...	...	94.5	—	95.2	—	97.5	—	99.6	—	96.2	—	95.6	—
	Floor...	...	...	—	80.8	—	88.4	—	82.0	—	89.4	—	79.0	—	92.7
AZ 2	Roof and Sides	...	...	—	95.2	—	97.2	—	97.4	—	95.2	—	88.5	—	99.5
	Floor...	...	...	77.7	—	86.3	—	81.7	—	86.4	—	85.1	—	85.8	—
AZ 3	Roof and Sides	...	...	96.4	—	98.4	—	94.8	—	94.7	—	90.4	—	94.4	—
	Floor...	...	...	—	80.4	—	89.6	—	84.5	—	93.8	—	83.9	—	91.4
AZ 4	Roof and Sides	...	...	—	99.9	—	98.0	—	92.0	—	95.6	—	91.3	—	98.6
	Floor...	...	...	79.8	—	81.6	—	80.4	—	92.3	—	88.0	—	87.1	—
AZ 5	Roof and Sides	...	...	90.6	—	98.1	—	95.5	—	98.1	—	93.5	—	97.7	—
	Floor...	...	...	—	86.1	—	92.0	—	78.3	—	92.2	—	90.6	—	91.7
AZ 6	Roof and Sides	...	...	—	99.5	—	96.6	—	98.2	—	98.2	—	97.3	—	98.3
	Floor...	...	...	69.6*	—	81.7	—	81.0	—	89.2	—	86.3	—	85.3	—
10 East Return Zone:															
AM 1	Roof and Sides	...	...	92.7	—	94.0	—	98.0	—	96.2	—	95.9	—	97.7	—
	Floor...	...	...	—	86.7	—	91.0	—	85.4	—	91.4	—	77.8	—	90.5
AM 2	Roof and Sides	...	...	—	95.2	—	97.1	—	97.8	—	99.6	—	93.9	—	98.5
	Floor...	...	...	79.6	—	75.4	—	85.9	—	90.6	—	91.4	—	89.6	—
10 East S's Return Zone:															
AS 1	Floor...	...	...	—	—	—	—	—	—	—	—	—	—	—	66.3†
AS 2	Roof and Sides	...	...	—	—	—	—	—	—	—	—	—	—	—	89.2
10 East S's Intake Zone:															
AT 1	Floor...	...	...	—	—	—	—	—	—	—	—	—	—	—	81.2
AT 2	Roof and Sides	...	...	—	—	—	—	—	—	—	—	—	—	—	93.9

\* This was resampled on 17.6.58 and the incombustible matter was then found to be 92.9 per cent.

† This was not resampled because of the occurrence of the explosion.

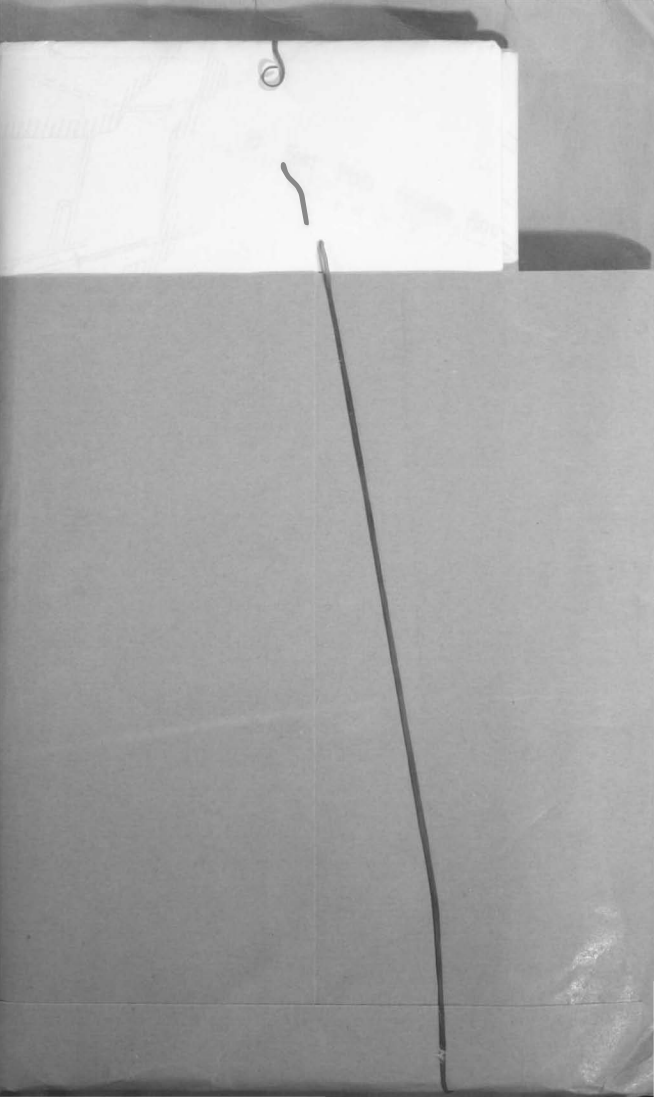
# APPENDIX 3

## WALTON COLLIERY

Results of analyses of dust samples taken by H.M. Inspectors  
in 10 East District, on 27th and 29th April

						<i>Incombustible Matter (per cent.)</i>		
						<i>Floor</i>	<i>Roof</i>	<i>Sides</i>
<b>A. 10 East Trunk Conveyor Road</b>								
Distance outbye from return drum of trunk conveyor (yards)								
0- 50	...	...	...	...	...	47.2		48.7
50-100	...	...	...	...	...	53.0		43.9
100-150	...	...	...	...	...	55.5		81.9
150-200	...	...	...	...	...	59.5	73.7	87.5
200-240	...	...	...	...	...	75.5		73.5
<b>B. 5's Intake Gate</b>								
Distance from face (yards)								
0- 50	...	...	...	...	...	60.6		44.8
50-100	...	...	...	...	...	76.1		63.6
<b>C. 5's Return Gate</b>						44.0		57.1
<b>D. 10 East Return</b>								
Distance outbye 2's Return (yards)								
0- 50	...	...	...	...	...	67.7		65.7
50-100	...	...	...	...	...	84.1		59.3
<b>E. 5's New Loader Gate</b>						48.8		67.0

NOTE: No samples were taken in 5's Ribside, which was not accessible.





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